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**Evaluation of the Highly Pathogenic Avian  
Influenza H5N1 Status of Suffolk and  
Norfolk Counties, England**



**United States Department of Agriculture  
Animal and Plant Health Inspection Service  
Veterinary Services  
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## Abbreviations

ADNS	Animal Disease Notification System
APHIS	Animal and Plant Health Inspection Service
CFR	<i>Code of Federal Regulations</i>
Defra	Department for Environment, Food and Rural Affairs
EC	European Community
EU	European Union
HPAI	Highly pathogenic avian influenza
OIE	World Organization for Animal Health
UK	United Kingdom of Great Britain and Northern Ireland
USDA	United States Department of Agriculture
VLA	Veterinary Laboratories Agency

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## 1. Executive Summary

Highly pathogenic avian influenza (HPAI) is a contagious viral disease of birds. The United States Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS) restricts the importation of birds and bird products from regions affected with HPAI caused by virus subtype H5N1 (HPAI H5N1). HPAI H5N1 is among the World Organization for Animal Health (OIE)-listed diseases of concern for international trade, and is reportable to the OIE. In February 2007, the Chief Veterinary Officer of the United Kingdom of Great Britain and Northern Ireland (UK) reported to the OIE the occurrence of HPAI H5N1 in domestic poultry in Suffolk county, England, near the border with Norfolk county. Emergency response measures implemented by UK animal health authorities included establishing a restricted zone of control measures that encompassed parts of both Suffolk and Norfolk counties. In response to this HPAI H5N1 outbreak, APHIS added Suffolk and Norfolk counties to the list of regions that APHIS considers to be affected with HPAI H5N1. This resulted in the restriction of importation of some categories of birds and bird products into the United States from those two counties, in accordance with APHIS regulations.

The February 2007 outbreak was followed by a second outbreak of HPAI H5N1 in domestic poultry in Suffolk county, in November 2007. Animal health authorities in the UK again implemented emergency control measures to prevent spread of the disease, and eradicate it from the domestic poultry population. These emergency measures were lifted on December 19, 2007. Additional surveillance revealed no evidence of subsequent cases of HPAI H5N1 in Suffolk or Norfolk county. On May 12, 2008, the UK notified the OIE that the outbreak had been resolved.

This document is an evaluation of the HPAI H5N1 status of Suffolk and Norfolk counties, conducted in response to a request from the UK that APHIS lift the import restrictions on those counties. The evaluation was conducted in accordance with guidelines developed by the OIE for evaluating the HPAI status of a region subsequent to an outbreak. Results of the evaluation indicate that a well-developed system is in place in the UK for rapid detection, control and eradication of HPAI H5N1. The effectiveness of this system was demonstrated during the two HPAI H5N1 outbreaks in Suffolk county in 2007. The results of this evaluation indicate that HPAI H5N1 was eradicated from Suffolk county and has not recurred there since the last detection in November 2007. APHIS found no evidence that HPAI H5N1 is currently present in Suffolk or Norfolk county. Thus, APHIS concludes it to be appropriate to remove Suffolk and Norfolk counties from the list of regions that APHIS considers to be affected with HPAI H5N1.

## 2. Introduction

APHIS regulates the importation of animals and animal products into the United States to guard against the introduction of animal diseases that are not present or prevalent in the United States. APHIS regulations pertaining to the importation of animals and animal products are set forth in title 9 of the *Code of Federal Regulations* (CFR) parts 91 through 99 [1]. These regulations include restrictions on the importation of some categories of birds and bird products from regions affected with HPAI H5N1 (9 CFR 93.101, 93.201, 94.6 and 95.30) [1, 2]. HPAI H5N1 is among the OIE-listed diseases of concern for international trade, and is reportable to the OIE [3].

On February 3, 2007, the Chief Veterinary Officer of the UK reported to the OIE the occurrence of HPAI H5N1 in domestic poultry in England, in northern Suffolk county, near the border with Norfolk county [4]. In response to this detection, the animal health authorities of the UK implemented avian influenza control and eradication measures, including establishing a restricted zone of control measures that encompassed parts of both Suffolk and Norfolk counties [5]. In response to this HPAI H5N1 occurrence, APHIS added Suffolk and Norfolk counties to the list of regions that APHIS considers to be affected with HPAI H5N1 [2].

In November 2007, HPAI H5N1 was again detected in domestic poultry in Suffolk county [6]. Animal health authorities in the UK implemented emergency control measures to prevent spread of the disease, and eradicate it from the domestic poultry population [7]. These emergency measures were lifted on December 19, 2007. Additional surveillance revealed no evidence of subsequent cases of HPAI H5N1 in Suffolk or Norfolk county. On May 12, 2008, the UK notified the OIE that the outbreak had been resolved [8].

This document is an evaluation of the HPAI H5N1 status of Suffolk and Norfolk counties, conducted in response to a request from the UK that APHIS lift the import restrictions on those counties. The evaluation was conducted in accordance with guidelines developed by the OIE for evaluating the HPAI status of a region subsequent to an outbreak [3]. The framework for the evaluation is an assessment of information in terms of its adequacy in supporting the following conclusions:

1. Suffolk and Norfolk counties have been free of HPAI H5N1 for at least 3 months, because of control measures implemented by an effective veterinary infrastructure;
2. HPAI was reportable in the UK and an ongoing awareness program was in place;
3. An effective surveillance program for HPAI that supported the detection and investigation of outbreaks was in place;
4. All reported suspected or confirmed cases of avian influenza were investigated;
5. The system for recording, managing and analyzing diagnostic and surveillance data was sufficient to demonstrate the effectiveness of the UK's HPAI H5N1 control measures;

6. Diagnostic laboratory capabilities were effective, and testing procedures were documented and standardized;
7. Eradication and control measures, including movement restrictions, were effectively implemented in response to outbreaks to prevent further spread of disease;
8. Procedures used for depopulation, cleaning and disinfection of affected premises were documented and effective.

The information that APHIS evaluated includes information from the website of the UK Department for Environment, Food and Rural Affairs (Defra), publicly available reports from Defra to the OIE and to the European Commission, European Community (EC) legislation, and information gathered by APHIS from the scientific literature and other public sources. The results of this evaluation are described below, organized into four main sections: Hazard Identification, Chronology of Events, HPAI H5N1 Status of Suffolk and Norfolk Counties, and Risk Estimation and Conclusions. The HPAI H5N1 Status section is structured in accordance with the 8 points listed above.

### 3. Hazard Identification

In this evaluation, the hazard under consideration is the HPAI virus subtype H5N1. All avian influenza viruses are type A influenza viruses [9]. Type A influenza viruses are enveloped RNA viruses of the Orthomyxoviridae family. They are classified into subtypes based on the antigenic characteristics of two glycoproteins, hemagglutinin and neuraminidase, that are expressed on the surface of the virus particle. HPAI H5N1 virus is of hemagglutinin type 5 and neuraminidase type 1. Type A influenza viruses are also classified based on the level of their pathogenicity. APHIS defines an avian influenza virus as highly pathogenic based on its mortality rate in infected chickens, on part of its hemagglutinin amino acid sequence, and on its growth characteristics in cell culture [10]. All HPAI viruses that have been isolated are of hemagglutinin type 5 or 7 (H5 or H7); however, most H5 and H7 influenza A viruses are of low virulence [9, 11-13].

The host range of HPAI H5N1 virus is broad: it has been reported to occur in more than 150 species [14, 15]. Most of these species are free-ranging wild birds and other vertebrates. Infected wild birds, particularly water birds, have been suggested to act as vectors in long-distance spread of HPAI H5N1 [9, 16, 17]. Results of phylogenetic analyses of viruses isolated from infected wild birds in various geographic regions indicate that HPAI H5N1 has spread across Asia, Europe and the Middle East, and into Africa [9].

Infected birds shed HPAI H5N1 virus in excretions and secretions, particularly feces and respiratory secretions [9, 11]. HPAI H5N1 virus has been detected in eggs, skeletal muscle and other tissues of infected birds [11]. Virus shedding can begin within 2-3 days after infection [11]. Transmission occurs primarily through fecal-oral and respiratory routes [9].

The incubation period of HPAI viruses is 3-5 days [12]. Clinical signs of infection can vary considerably. Factors affecting the type and extent of clinical expression include the viral subtype; the species, age and health status of the infected bird; and environmental factors [9, 13]. HPAI H5N1 virus infection in most gallinaceous birds, including chickens and turkeys, is associated with clinical signs such as cyanotic combs and wattles, subcutaneous hemorrhages, edema of the face and limbs, and gasping, and very high mortality [14]. Other species, such as geese and ratites, can develop neurological signs prior to death. Ducks have been reported to develop few or no clinical signs in some cases, and numerous clinical signs in others. Mortality of HPAI H5N1 in domestic poultry can reach 100%. In laying hens, HPAI can be associated with a marked decrease in egg production [9, 11, 13].

HPAI viruses can remain infective in feces and water [12]. They are inactivated by acid pH and high temperatures, and by various chemicals such as oxidizing agents and disinfectants such as formalin and iodine compounds. Avian influenza viruses can be spread through direct contact with feces and other excretions and secretions from infected birds; or with contaminated feed, water, equipment and clothing. Infected wild birds, in particular sea birds and other waterfowl, can introduce the virus into domestic flocks. HPAI viruses can be transmitted through consumption of raw poultry or poultry products derived from infected birds [11].

## **4. Chronology of Events**

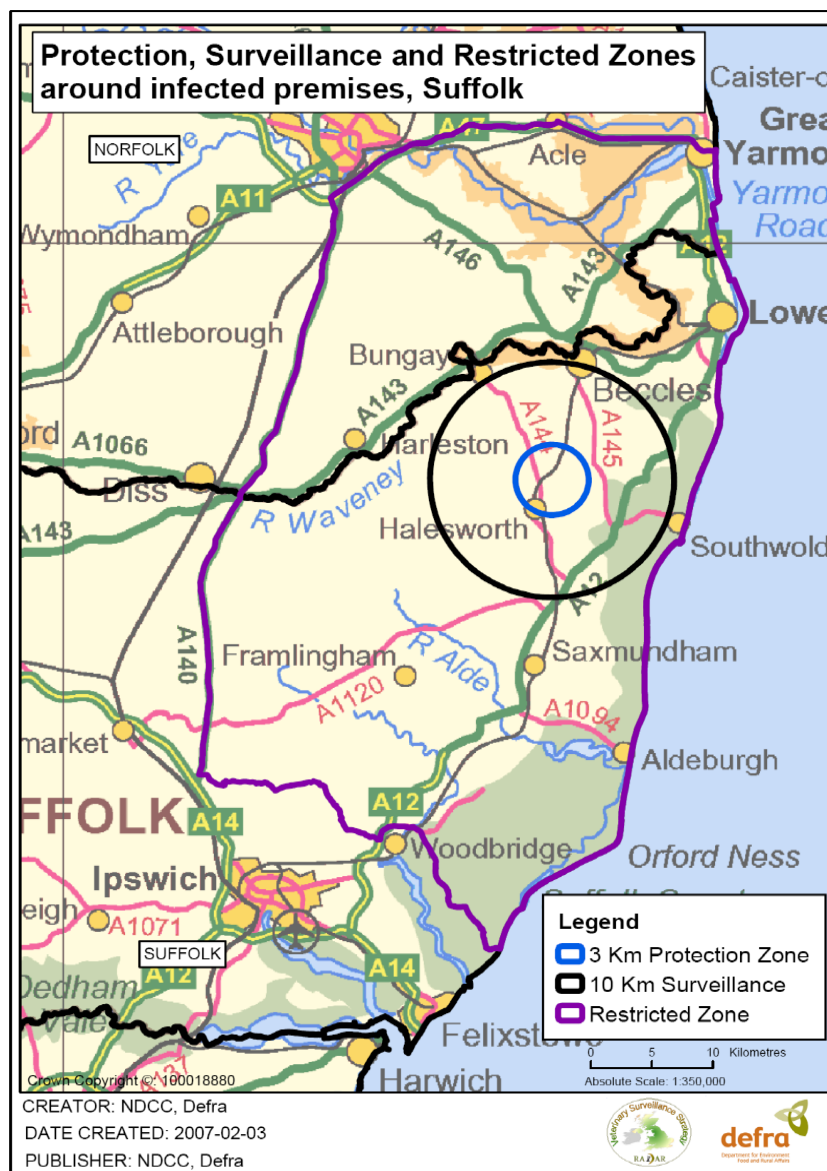
### February 2007 outbreak of HPAI H5N1 in Suffolk county

On the evening of February 1, 2007, a company veterinarian at a commercial turkey farm in Upper Holton, northern Suffolk county, England reported suspected occurrence of HPAI in turkeys at the farm to the local animal health authority [5, 18]. On February 2, an official veterinary inquiry was begun, including sample collection for laboratory analysis [19]. On February 3, laboratory results confirmed the detection of HPAI H5N1 virus [5]. This was the first confirmed case of HPAI H5N1 in a commercial poultry flock in the UK [19]. The animal health authorities in the UK immediately implemented emergency response measures. National and local disease control centers were established; the European Commission and OIE were notified; and exports of susceptible commodities were suspended [19].

The response measures also included defining the geographic regions to which control measures of various levels of stringency applied [20]. These regions are designated protection, surveillance and restricted zones, and were defined and established in accordance with EC legislation (see Figures 1 and 2, and Section 5.7). They were established on February 3, 2007 [5]. The largest of these defined regions, the restricted zone, included parts of both Suffolk and Norfolk counties (Figure 2) [20].



**Figure 1. Location of February 2007 HPAI H5N1 outbreak in Suffolk county.**



**Figure 2. Protection, surveillance and restricted zones established in response to February 2007 HPAI H5N1 outbreak in Suffolk county.**

In response to this HPAI H5N1 detection, APHIS added Suffolk and Norfolk counties to the list of regions that APHIS considers to be affected with HPAI H5N1 [2]. This resulted in the restriction of importation of some categories of birds and bird products into the United States from those two counties, in accordance with regulations set forth in 9 CFR parts 93, 94 and 95 (93.101, 93.201, 94.6, 95.30) [1, 2].

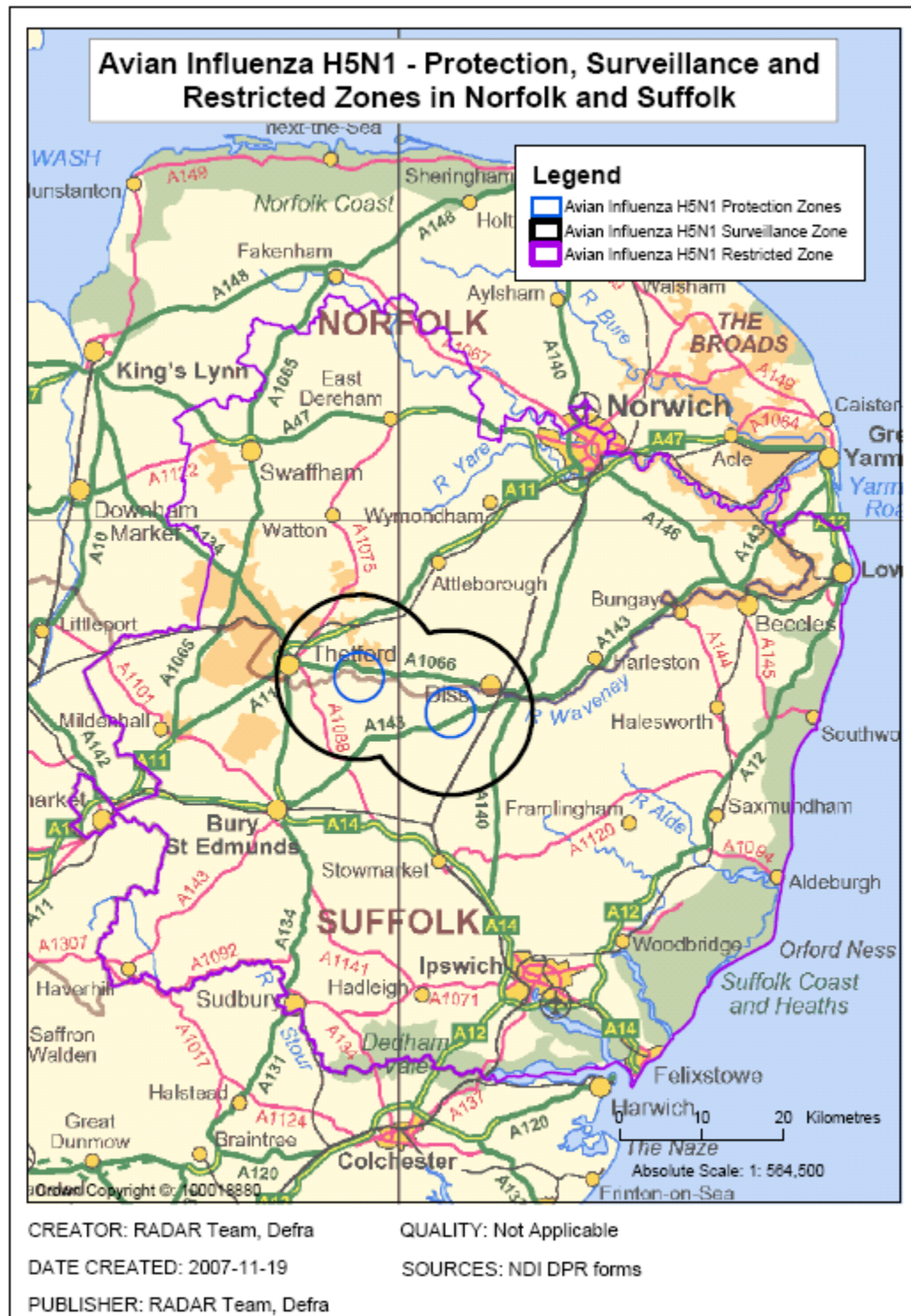
Culling of birds on the farm was completed on February 5, and preliminary cleaning and disinfection were completed on February 8 [5]. The National Emergency Epidemiology Group of Defra conducted epidemiological investigations into the outbreak and concluded that the outbreak was confined to a single farm [5]. The protection zone measures were lifted on March 1, and the surveillance and restricted zone measures were

lifted on March 12, in accordance with EC procedures [21-23]. Final cleaning and disinfection of the affected premises were completed on June 25, 2007 [24]. On October 8, 2007, the Chief Veterinary Officer of the UK reported to the OIE that as of October 6, 2007, the UK had regained its status as free of OIE-reportable avian influenza, in accordance with OIE criteria [3, 24].

#### November 2007 outbreak of HPAI H5N1 in domestic poultry in Suffolk county

On November 11, 2007, suspected occurrence of avian influenza in a free-range turkey flock was reported to the local animal health authority in Suffolk county [7]. This flock was located on a farm approximately 25 miles west of the site of the February 2007 outbreak [6, 7]. Animal health authorities in the UK again immediately implemented emergency response measures. On November 11, samples were collected for laboratory analysis [7]. The next day, preliminary laboratory results confirmed the detection of HPAI virus of subtype H5 [7]. Movement control zones were established, and the European Commission was notified [7, 25]. On November 13, laboratory results confirmed the detection of HPAI H5N1 [7]. The OIE was notified, and culling of birds on the affected premises commenced [6, 7]. Culling was completed on November 15, and preliminary cleaning and disinfection were completed on November 17 [7, 26].

On November 19, epidemiological investigations revealed HPAI H5N1 virus infection in turkeys on a free-range turkey farm that was identified as epidemiologically linked to the index premises [7, 26]. The same day, the protection, surveillance and restricted zones that had been established were revoked, and new zones were established to take into account the second affected premises (Figure 3) [27].



**Figure 3. Protection, surveillance and restricted zones established in response to November 2007 HPAI H5N1 outbreak in Suffolk county.**

Preliminary cleaning and disinfection of these premises were completed on November 19 [7]. On December 19, the protection, surveillance and restricted zone measures were lifted [28].

The HPAI H5N1 virus isolated in the November 2007 outbreak is phylogenetically distinct from the HPAI H5N1 virus isolated in the February 2007 outbreak [7]. The epidemiological investigations and increased surveillance revealed no evidence of further spread of infection. Additional surveillance has revealed no evidence of subsequent HPAI H5N1 occurrence in Suffolk and Norfolk counties [5, 7, 29, 30]. On May 12, 2008, the Acting Chief Veterinary Officer of the UK reported to the OIE that the outbreak had been resolved [8].

## 5. HPAI H5N1 Status of Suffolk and Norfolk Counties

### 5.1 Veterinary infrastructure, and freedom from HPAI H5N1

*Suffolk and Norfolk counties have been free of HPAI H5N1 for at least 3 months because of control measures implemented by an effective veterinary infrastructure.*

#### Organization of the official veterinary services

The UK consists of England, Scotland, Wales and Northern Ireland [31]. The central competent authority responsible for animal health and welfare in the UK is Defra [32]. Defra also acts as regional authority for England responsible for animal health and welfare. Responsibility for animal health legislation, implementation and controls in Scotland, Wales and Northern Ireland lies with respective Devolved Administrations of those regions (the Scottish Executive, the National Assembly for Wales, and the Northern Ireland Assembly). The discussion of veterinary controls and infrastructure in this evaluation will focus on those in England, where the HPAI H5N1 outbreaks that are considered in this evaluation occurred.

Defra is headed by a Permanent Secretary, who is responsible for the overall organization and management of Defra [33]. The Permanent Secretary also serves as the chair of Defra's Management Board, which is responsible for providing strategic leadership to Defra. The Chief Veterinary Officer is a member of the Defra staff [34].

Defra delivers services through a network of "delivery partners", which include Executive Agencies of Defra as well as non-departmental public bodies, public corporations, and regional and local authorities [35]. Oversight and coordination of delivery partners' activities are provided by the Delivery Partners Coordination Unit of Defra and by the Local Authorities Coordinators of Regulatory Services, a local government central body responsible for overseeing local authority regulatory and related services in the UK [32, 36, 37].

The principal delivery partner responsible for maintaining and improving animal health in Great Britain (England, Scotland and Wales) is Animal Health, an Executive Agency of Defra [37]. This agency is responsible for coordinating, implementing and enforcing veterinary controls related to animal health and welfare and international trade, including efforts such as animal disease prevention, control and eradication, and animal disease outbreak emergency response preparedness [32, 37, 38]. Animal Health is headed by a Chief Executive Officer, who is appointed by the Secretary of State and is responsible for overall performance of the agency [37]. Detailed guidance regarding animal health control procedures and roles and responsibilities of Animal Health staff is provided through a set of operating instructions that are available by intranet. These instructions are updated continuously to reflect current policy.

Animal Health has 24 Divisional Offices in Great Britain, each of which is headed by a Divisional Veterinary Manager [32, 37]. The staff of each Divisional Office includes veterinary, technical and administrative personnel, and a Readiness and Resilience Manager who is responsible for contingency planning. The Divisional Office for Suffolk and Norfolk counties is the Bury St Edmunds Animal Health Office, located in Bury St Edmunds, Suffolk [39].

Responsibility for enforcement of animal health rules in England at the local level rests with 149 local authorities [37]. Local authority regulatory services in England are funded by local taxes, and by a central government grant. In addition, direct funding for animal health control measures is available from Defra. Local authority responsibilities include inspecting farm premises, livestock markets and shows, slaughterhouses and animal transport vehicles; and enforcing disease control legislation.

The mechanisms and structure of cooperation between local authorities, Divisional Offices and Animal Health in delivery of animal health services are formalized in an Animal Health and Welfare Framework Agreement [37]. Under this agreement, each local authority and respective Divisional Office agree annually on a service delivery plan, which includes benchmarks for standards of performance, management information, audit standards, control procedures and requirements for professional qualification of enforcement staff. The agreement requires local authorities to record animal health control enforcement activities and outcomes in a web-based enforcement database that is managed by Defra, and provides management information to all participants in the agreement.

The structure and organization of official controls related to animal health in the UK are set forth in a multiannual National Control Plan [37, 40]. This Plan details the roles and responsibilities of the various authorities involved in monitoring for compliance with, and enforcement of, animal health rules, and provides the basis of assessments of the performance of the UK's national control systems by the European Commission's inspection services [41].

The International Animal Health Division of Defra is responsible for import policy in England, and sets national rules where no European Union (EU) conditions are in place [37, 42]. It also negotiates import rules for the UK in the EU [42]. Import and EU trade controls are enforced in England by Animal Health and local authorities [42].

#### Legal authority for animal health activities

As a Member State of the EU, the UK is bound by all applicable EC Regulations, Decisions and Directives, including those related to veterinary activities and control of infectious animal diseases [43]. EC Regulations and Decisions are binding in their entirety on EU Member States. Directives are binding in terms of the results to be achieved, but the form and methods of application of Directives are left to the national authorities of the Member States.

National legislation of the UK through which EC legislation pertaining to animal health controls is implemented is listed by topic on the Defra website [44]. Copies of this legislation, as well as EC legislation, are publicly available online [45, 46]. Lists of the main instruments of EC and UK legislation pertaining to avian influenza control in England are provided in the Appendix.

In 2004, an EC Regulation was published aimed at establishing an EC-wide framework for official controls of animal health [47]. This Regulation sets out the approach to be taken and principles to be adopted by the competent authorities of EU Member States that are responsible for official controls of animal health. It also provides the legal basis for

the European Commission to assess the effectiveness of national enforcement mechanisms [40].

The legal basis for enforcement of the provisions of this Regulation in England is the Official Controls (Animals, Feed and Food) (England) Regulations 2006 [40, 48]. These Regulations provide for designation of the Secretary of State and local authorities as competent authorities for enforcement of animal health and welfare rules, and create powers for competent authority auditors to conduct audits required by EC regulations. They also provide for exchange of information between competent authorities in England and elsewhere in the UK and in the European Union.

The principal legislation regarding animal health in Great Britain is the Animal Health Act 1981 and Orders issued under that Act, and Regulations established under the European Communities Act 1972 [37]. This legislation provides for implementation of measures to prevent and eradicate animal diseases, including control and monitoring of imports and trade within the EC, and controls on and monitoring of premises where animals are kept. Most of the powers for control of outbreaks of avian influenza in England are provided by the Animal Health Act 1981 [49]. The Avian Influenza and Newcastle Disease (England and Wales) Order 2003, issued under this Act, provides authority for slaughter of diseased poultry, as well as poultry suspected to be diseased and poultry exposed to disease, and authority for preventive slaughter.

EC rules for control of avian influenza in poultry and other captive birds are set forth in Directive 2005/94/EC [50]. The requirements of this Directive are implemented in England through the Avian Influenza and Influenza of Avian Origin in Mammals (England) (No. 2) Order 2006 and the Avian Influenza (Vaccination) (England) Regulations 2006. The scope of this legislation includes requirements for reporting of disease suspicion to competent authorities; veterinary investigation; implementation of movement restrictions; authority for entry to premises to test and slaughter; and provisions for preventive and emergency vaccination, subject to approval from the European Commission.

EC rules specific to control of HPAI H5N1 are set forth in Decision 2006/415/EC and Decision 2006/563/EC. The requirements of these Decisions are implemented in England through the Avian Influenza (H5N1 in Poultry) (England) Order 2006 and the Avian Influenza (H5N1 in Wild Birds) (England) Order 2006. The scope of these requirements includes establishment of control zones; and movement controls for live poultry, hatching eggs, and poultry products.

#### Controls on international trade

International trade of animals and animal products to or from the UK is governed by both EC and UK legislation. The EC legislation is designed to ensure that animals and animal products imported into EU Member States meet standards at least equivalent to those required for production in, and trade between, EU Member States [51]. EC legislation governs both importation into the EU and trade among EU Member States [42].

In general, animals and animal products can be legally imported into the EU only from third countries or parts thereof that are approved for export to the EU by EC legislation, and only through border inspection posts approved by the European Commission [52-54].

In most cases, evaluation of a country's application for approval involves an on-site inspection by the Food and Veterinary Office of the European Commission Directorate-General for Health and Consumer Protection, to determine whether the animal health situation and relevant official services, legal provisions, control systems and production standards meet EU requirements [51].

Defra has the authority to prohibit importation of animals and animal products that might pose a threat to animal or public health, such as importation from regions affected with avian influenza [55]. This authority is provided by the Animals and Animal Products (Import and Export) (England) Regulations 2006, the Products of Animal Origin (Import and Export) Regulations 1996, and other regulations. Declarations of import prohibitions, as well as specific guidance regarding requirements and restrictions on importation of animals and animal products, are published on the Defra website [55, 56]. These declarations include restrictions on trade into the UK due to avian influenza occurrence in regions outside the UK [56].

#### Laboratory services

Diagnostic laboratory services for animal disease are provided by the Veterinary Laboratories Agency (VLA), an executive agency of Defra [57]. The VLA is a network of 15 regional laboratories in England, Scotland and Wales, and a central research and diagnostic facility in Surrey County, England [57, 58]. Additional information about the VLA and diagnostic capacity for avian influenza is provided in Section 5.6.

#### External auditing

The veterinary services of all EU Member States, including the UK, are audited regularly by the European Commission to ensure that applicable EC legislation is properly implemented and enforced [47, 59]. General rules and procedures for veterinary inspections and audits by the European Commission are established by Commission Decision [60]. The audits include on-site inspections by mission teams from the Food and Veterinary Office. The schedule for these inspections is set annually and reviewed mid-year, to ensure that it remains up to date and relevant [59]. The findings of each inspection are described in an inspection report, together with conclusions and recommendations. The competent authority of the Member State visited is requested to present an action plan to the Food and Veterinary Office on how it intends to address any shortcomings identified in the inspection. The Food and Veterinary Office evaluates this action plan and monitors its implementation through a number of follow-up activities. Both the inspection schedule and the inspection reports, with any responses from the country visited, are publicly available [59].

Subjects of recent animal health-related inspections in the UK include import controls and border inspection posts (2005 and 2006) and intra-Community trade in live animals (2006) [59]. A general review by the Food and Veterinary Office of UK veterinary services, as well as an inspection focused on import and transit controls and border inspection posts, were scheduled for 2008 [61, 62].

#### Freedom of Suffolk and Norfolk counties from HPAI H5N1

HPAI H5N1 was most recently detected in Suffolk county in February and November 2007 [8, 24]. In response to each outbreak, UK animal health authorities immediately

implemented emergency response measures to prevent spread of the disease and eradicate it. These measures included establishing a restricted zone of control measures that encompassed parts of both Suffolk and Norfolk counties. Epidemiological investigations and enhanced surveillance for HPAI in Suffolk and Norfolk counties revealed no evidence of subsequent HPAI H5N1 occurrence in Suffolk or Norfolk county [7, 29, 30]. Reporting requirements are described in Section 5.2. HPAI surveillance measures are described in Section 5.3. Emergency response measures are described in Section 5.7.

### Conclusions

A well-developed veterinary infrastructure is in place in the UK. The official veterinary services appear to have sufficient legal authority and resources to carry out animal health activities quickly and effectively. Responsibilities and procedures for control and eradication of HPAI H5N1, regulation of animal and animal product movement, and regulation of the import and export of animals and animal products are well defined and documented.

Emergency response measures were promptly implemented in response to each of the HPAI H5N1 outbreaks in Suffolk county in 2007. The results of this evaluation indicate that these measures were effective in controlling the outbreaks and eradicating HPAI H5N1 from Suffolk county. APHIS found no evidence that HPAI H5N1 has occurred in Suffolk or Norfolk county since the November 2007 outbreak in Suffolk county. APHIS concludes that effective systems of both the UK and the EU are in place to detect, control and eradicate HPAI H5N1, and that these control measures are effectively applied.

## **5.2 HPAI reporting requirements and awareness**

*HPAI was reportable in the UK and an ongoing HPAI awareness program was in place.*

### Reporting requirements

The EC requires that all EU Member States ensure that both the suspected presence and the presence of specified types of avian influenza are compulsorily and immediately reported to the competent authority [23]. Reportable avian influenza is defined by EC Directive as infection caused by any influenza A virus of subtype H5 or H7, or of at least a specified minimum pathogenicity level. This requirement is implemented in the UK under authority of the Animal Health Act 1981 [63]. Any person who has in his possession or under his charge any bird or bird carcass that has, or he suspects to have, reportable avian influenza must immediately notify the Divisional Veterinary Manager, and take all reasonable steps to ensure that the appropriate legislatively prescribed control measures are complied with [64].

As an EU Member State, the UK is required to report to the European Commission and other Member States within 24 hours any primary outbreaks of avian influenza, as well as the removal of restrictions imposed in response to any outbreaks of avian influenza [65]. EU Member States must notify the European Commission at least weekly of secondary outbreaks of avian influenza. This information is forwarded by the European Commission to all EU Member States. In addition to these requirements, EU Member States must notify the European Commission of confirmed occurrence of avian influenza in slaughterhouses, means of transport, border inspection posts and elsewhere at EC

borders and quarantine facilities or centers operating in accordance with EC legislation on importation of poultry or other captive birds [23].

As a member of the OIE, the UK is subject to OIE guidelines for animal disease reporting. These guidelines specify that OIE members are to inform the OIE within 24 hours of the occurrence of any OIE-listed disease, including HPAI, and to submit weekly follow-up reports [66]. OIE members are also to submit to the OIE six-monthly reports on the absence or presence of HPAI and information of epidemiological significance to other countries; and an annual report of information of significance to other countries. The immediate notifications of disease occurrence, and summaries of other animal health related information reported to the OIE by OIE members, are publicly available on the OIE website [29].

#### Avian influenza awareness

Efforts by Defra to raise awareness among the public regarding avian influenza include publication of a wide variety of information on the topic on a Defra avian influenza website, and on leaflets, posters and postcards; and dissemination of information through local and national media [5, 49, 67]. The information is targeted at the general public, as well as at specific groups such as bird keepers, importers and exporters. The information provided ranges from basic information about avian influenza, including clinical signs, means of transmission and control measures; to reporting requirements; surveillance activities and results; contingency planning; and trade restrictions, including import and export restrictions and certification requirements.

Public outreach by Defra during and subsequent to the 2007 outbreaks of HPAI H5N1 in Suffolk county included the publication of detailed information specific to the outbreaks on its website, such as information regarding changes in movement restrictions and other disease control measures [67]. The website was updated frequently to reflect changes in the outbreak situation and in the control measures in force. Other public outreach included frequent news releases regarding the outbreak situation and publication of epidemiological investigation results [67, 68]. Registered flock owners were contacted directly through the Great Britain Poultry Register (see Section 5.5) [5].

#### Reporting associated with the 2007 HPAI H5N1 outbreaks in Suffolk county

The events related to the February and November 2007 outbreaks of HPAI H5N1 in Suffolk county were reported to animal health authorities in the UK and the international community in accordance with guidelines and requirements established by the UK animal health authorities, the EC and the OIE.

On February 1, 2007, the suspected occurrence of avian influenza in turkeys in a finishing unit on a farm in north Suffolk was reported to Animal Health, based on clinical signs (lethargy, anorexia, leg weakness) and increased mortality in one house of the unit during the previous several days [5, 19]. On February 2, 2007, Defra issued a news release reporting that preliminary results of laboratory analyses indicated the presence of avian influenza virus subtype H5 in samples from poultry found dead on the premises, and reporting on the implementation of control measures [69]. On February 3, 2007, the UK's Chief Veterinary Officer reported in an Immediate Notification Report to the OIE that the strain had been identified as an HPAI H5N1 virus by laboratory diagnostics [4].

The same day, Defra issued three news releases, confirming the detection, providing additional information regarding the strain type and control measures implemented, and reporting that the European Commission had been notified [70-72].

In the subsequent 8 months, the UK issued a total of 22 OIE follow-up reports regarding the outbreak [73]. These reports contained updates of epidemiological investigations and control measures implemented. In the final report on October 8, 2007, the UK declared that the outbreak had been resolved, with final cleaning and disinfection completed and all zone restrictions lifted, and declared the country to be free of OIE-reportable avian influenza as of October 6, 2007 [24, 29]. Additional reporting of the February 2007 outbreak situation consisted of additional Defra news releases, epidemiological investigation reports, reports to the EC and a report of lessons to be learned from the outbreak [5, 19-21, 74-76]. All of these reports were published online and are publicly available.

Similarly, events surrounding the November 2007 outbreak of HPAI H5N1 in Suffolk county were promptly reported to the appropriate animal health authorities in the UK and the international community, and to the public. On November 11, 2007, the suspected occurrence of avian influenza in turkeys on a commercial premises in north Suffolk was reported to Animal Health, based on increased mortality in one house of the premises during the previous several days [7]. On November 12, 2007 Defra issued two news releases, reporting that results of preliminary tests revealed the presence of an H5 strain and that the European Commission had been notified, and describing control measures that were being implemented [25, 77]. On November 13, 2007, the UK reported in an Immediate Notification Report to the OIE that the strain had been identified as an HPAI H5N1 virus by laboratory diagnostics [6]. In the subsequent 6 months, the UK issued a total of 8 OIE follow-up reports regarding the outbreak [78]. These reports contained updates of epidemiological investigations and control measures implemented. In the final report on May 12, 2008, the UK declared that the outbreak had been resolved [8, 29]. Additional reporting of the November 2007 outbreak situation consisted of additional Defra news releases, an epidemiological investigation report, and reports to the EC [7, 26, 74, 79-81]. All of these reports were published online and are publicly available.

### Conclusions

Reporting of suspected or confirmed cases of HPAI in the UK to the appropriate animal health authorities is mandatory, by authority of both EC and national legislation. In accordance with the provisions of this legislation, the suspected or confirmed occurrence of HPAI was promptly reported to the appropriate animal health authorities in both of the 2007 outbreaks in Suffolk county. Similarly, in accordance with EC requirements and OIE guidelines, Defra promptly notified the EC and the OIE of the outbreaks. The initial notifications to the EC and the OIE were followed by updates of the outbreak situation, including laboratory test results, measures implemented to control the outbreaks and eradicate the disease, and the results of epidemiological investigations. Throughout the outbreaks, Defra made detailed information regarding the outbreaks publicly available on its website. The reporting systems at the local, national and international levels were efficiently and effectively implemented.

Information provided to the public by Defra to raise awareness of avian influenza covers a broad range of topics. Both general information and information specific to various interest groups such as bird keepers, importers and exporters is provided. The awareness efforts appear to be sufficient to ensure that the institutions and individuals involved in avian influenza control are aware of their responsibilities, and to ensure timely reporting of any suspected or confirmed occurrence of HPAI.

### 5.3 Surveillance

*A surveillance program for HPAI was in place that addressed the UK's needs. This program supported the detection and investigation of outbreaks, including clinical inspection, active and passive surveillance (both serological and agent detection), and serological and virological testing in high-risk areas and of high-risk flocks. These actions were sufficient to detect disease quickly, even in the absence of clinical signs.*

EC legislation requires that EU Member States conduct surveillance for avian influenza in both domestic poultry and wild birds [23]. The surveillance programs must comply with EC guidelines [23, 82]. These guidelines specify the objectives and criteria for surveillance, sampling design and laboratory testing procedures [82].

The strategy for veterinary surveillance in the UK is set forth in the 10-year Veterinary Surveillance Strategy published by Defra in 2003 [83]. It is aimed at facilitating rapid identification of emerging risks to animal health, and prompt implementation of preventive or control measures. It is designed to provide a framework for integrating surveillance data and activity from multiple sources; identifying, analyzing and tracking animal health threats; and prioritizing surveillance activity.

In 1999, the Surveillance Group on Diseases and Infections of Animals was established to coordinate programs of surveillance of animal health and welfare on farms [84]. The group is chaired by the Chief Veterinary Officer, and comprises representatives from the four Agricultural Departments of the UK, the Department of Health, the Food Standards Agency and the Public Health Laboratory Service. Among the charges of the group are to review surveillance information; identify gaps and national surveillance needs; prioritize surveillance programs; and review the results of surveillance programs. Minutes and summaries of the group meetings, as well as associated papers such as avian influenza updates, are available through the Defra website.

In accordance with EC requirements, the strategy for avian influenza surveillance in the UK covers both domestic poultry and wild birds [85-87]. It includes a National Survey for Avian Influenza Viruses of Subtypes H5 and H7 in Domestic Poultry, investigation of any suspect cases of reportable avian disease, including HPAI, in poultry, a wild bird survey for avian influenza viruses, investigation of the causes of unusually high mortality events in wild birds and encouraging the public to report signs of avian influenza to animal health authorities.

The system in place for recording, managing and analyzing surveillance data is described in Section 5.5. Information on the diagnostic laboratory system and procedures is provided in Section 5.6.

### Surveillance in domestic poultry

Defra recognizes animal owners and veterinarians as key first-line observers in veterinary surveillance, and strongly encourages vigilance for the clinical signs of avian influenza [85, 86, 88]. Information for bird owners and other members of the public regarding clinical signs of avian influenza, biosecurity, and what to do in the event of avian influenza suspicion is published on the Defra website and in Defra pamphlets and posters [85, 86]. Tissue samples and carcasses can be submitted to the VLA for analysis [88].

Active surveillance for avian influenza virus subtypes H5 and H7 in domestic poultry is conducted as part of the National Survey for Avian Influenza Viruses of Subtypes H5 and H7 in Domestic Poultry [89]. This annual survey, conducted since 2003, is a cooperative effort among the poultry industry, Animal Health, the VLA and Defra. In this survey, blood samples are collected from a wide variety of poultry species from a sample of premises, and tested for the presence of antibodies to avian influenza viruses subtypes H5 and H7. Positive results are followed up on through veterinary investigation and further sampling and testing to confirm or rule out the presence of avian influenza virus.

### Surveillance in wild birds

Surveillance for avian influenza in wild birds in the UK is targeted to areas and species in which the likelihood of detecting H5N1, if it were present, would be highest, and to areas where H5N1 introduction might have a significant impact on poultry health [85, 90, 91]. Sampling is targeted geographically to areas with an abundance of migratory water bird species and domestic poultry, and temporally to periods during which the largest numbers of migratory water birds are present in the UK [85]. Most migratory water birds tend to leave the UK for their summer breeding grounds in more northerly latitudes during the spring. In the autumn, many migratory water birds travel south again to warmer areas such as the UK, where they spend the winter months. Wild bird survey efforts in the UK are therefore focused on the autumn migratory period and overwintering period. A map of wild bird surveillance priority counties is available on the Defra website [92, 93]. Both Suffolk and Norfolk counties are among the designated wild bird surveillance priority counties.

The three main components of surveillance for avian influenza in wild birds are sampling of wild birds caught live at wetland sites throughout the UK, sampling of birds shot during normal wildfowl hunting during the September to February hunting season and sampling of wild birds found dead in designated surveillance areas [85]. As part of this surveillance, selected wetland reserves across the UK are patrolled regularly by staff during autumn, winter and early spring. Dead wild birds are subjected to laboratory testing for avian influenza virus.

The investigation of unusually high mortality events in wild birds is a separate survey to determine the causes of deaths of large numbers of birds [87]. Postmortem examinations of birds are conducted in incidents in which at least 10 birds are found dead in the same location and at the same time. Such die-offs might be caused by any of a variety of factors, such as poisoning, adverse weather conditions, starvation or one of a number of infectious diseases. Samples collected in these surveys are screened for avian influenza viruses.

Public reporting also plays a role in wild bird surveillance in the UK. As in the case of surveillance for avian influenza in domestic poultry, Defra strongly encourages members of the public to remain vigilant of clinical signs of avian influenza in wild birds, and to report signs of avian influenza in wild birds, and sightings of dead wild birds, to animal health authorities [85, 87].

#### International monitoring

In addition to conducting surveillance for HPAI in poultry and wild birds within the UK, Defra monitors HPAI outbreaks worldwide to assess the risk that those events might pose to the UK [94]. These assessments are conducted by the International Disease Surveillance team, part of the International Animal Health Division of Defra. Preliminary outbreak assessments, qualitative risk assessments and routine summary reports are regularly distributed within the government, posted publicly on the Defra website, or published in the Veterinary Record, the official journal of the British Veterinary Association.

#### Surveillance in response to HPAI H5N1 outbreaks

In response to the HPAI H5N1 outbreaks in Suffolk county in 2007, Defra increased its avian influenza surveillance activities in accordance with well-defined procedures, and in accordance with UK and EC legislation [5, 7, 23, 95]. A clearly defined protection zone of 3 km radius and surveillance zone of 10 km radius were established around each site of infection (see Section 5.7). These zones were subject to increased surveillance for avian influenza. Flocks in the protection and surveillance zones were identified through existing databases such as the Great Britain Poultry Register (see Section 5.5), and through door-to-door patrols [5].

All flocks in the protection and surveillance zones were visited for clinical inspection and, if appropriate, examination of production records [5, 7]. Oropharyngeal and cloacal swabs and blood samples were collected for virological and serological analysis by the VLA. Sampling was designed to enable detection of HPAI H5N1 at a prevalence of at least 5% with 95% confidence, in each epidemiological unit on the premises [7]. All samples were negative for HPAI H5N1 [5, 7].

Premises located outside the protection and surveillance zones but identified through the epidemiological investigations as potentially exposed were also subject to additional surveillance by animal health authorities. These measures resulted in identification of a second affected premises in the November 2007 outbreak of HPAI H5N1 in Suffolk county [7]. These premises were located outside the protection and surveillance zones, but within the restricted zone, established around the index premises. New protection, surveillance and restricted zones were immediately established to take into account the second affected premises [27]. No other evidence of HPAI H5N1 spread was found.

Surveillance efforts also included raising avian influenza awareness among flock owners through information dissemination on the Defra website, through local and national media, and by directly contacting individuals registered in the Great Britain Poultry Register (see Section 5.5) [5].

## Conclusions

An effective program for HPAI surveillance was and is in place in the UK. This program supports the detection, reporting and investigation of HPAI outbreaks in the UK, and includes clinical inspection, active and passive surveillance, and laboratory testing. The program includes provisions and criteria for defining high-risk premises and zones, and for additional testing there for avian influenza. The program is effectively implemented, and is sufficient to detect HPAI quickly.

### **5.4 Investigation of suspected and confirmed cases**

*Under the surveillance program, all reported suspected or confirmed cases of avian influenza were investigated, and officials took appropriate actions including collecting samples, transporting these samples in a manner that ensured their integrity for testing purposes, and documenting subsequent laboratory results.*

#### EC and UK requirements and procedures

The European Commission has established requirements for investigating suspected and confirmed cases of avian influenza in EU Member States [23]. In the event of suspected occurrence of avian influenza on a poultry holding, the competent authority must immediately start an investigation to confirm or rule out the occurrence of avian influenza, and ensure that disease control measures specified by the applicable EC legislation are applied (see Section 5.7). In the event of suspected or confirmed occurrence of HPAI in a slaughterhouse or means of transport, the competent authority must immediately start an investigation in the holding of origin. The scope of epidemiological investigations for avian influenza must include at least the possible origin of the disease, identification of any contact holdings, and identification of means by which the virus might have spread. In the event that HPAI is detected in wild birds, the competent authority must implement disease control measures and increased surveillance. EU Member States must ensure that diagnostic procedures, sampling and laboratory testing are carried out in accordance with an EU diagnostic manual for avian influenza [23, 95]. This manual specifies criteria and procedures to be followed for clinical or postmortem examination; sampling methods to be used for serological or virological screening; and criteria and procedures for collecting samples for laboratory testing [23].

The Defra agency Animal Health is responsible for promptly investigating all cases of suspect reportable diseases and taking appropriate measures for control, eradication and prevention [37]. Protocols for sample collection and submission for laboratory analysis are published on the Defra website [96].

In both of the 2007 HPAI H5N1 outbreaks in Suffolk county, the initial reports of suspected or confirmed occurrence of avian influenza were promptly investigated. Blood samples and cloacal and oropharyngeal swab samples were promptly collected for, and subjected to, serological and virological analysis to confirm or rule out HPAI [5, 7]. In both cases, preliminary laboratory results (hemagglutinin type) were available the next day. The hemagglutinin and neuraminidase types of the avian influenza strains were identified within two days. Emergency control measures were implemented immediately upon the initial reports of suspected occurrence (see Section 5.7).

In both outbreaks, thorough epidemiological investigations were initiated immediately [5, 7]. These were led by Defra, and involved data collection to determine the likely source and means of introduction of the infection, and the risk of further transmission. The investigations also included reviews of farm production records and practices; interviews with farm staff; evaluations of wild bird movement patterns; and assessments of the types and numbers of wild birds in and near the affected areas, and their potential for contact with domestic poultry.

Details of the epidemiological investigations are available on the Defra website [5, 7]. Defra published the procedures used in the investigations, as well as their results, in preliminary and follow-up epidemiological reports. The preliminary reports were published within two to three weeks after the detection was confirmed.

Results of the laboratory investigations conducted are included in the epidemiological reports. In addition, records of all submissions to, and diagnoses made by, VLA are recorded in a VLA database called Veterinary Investigation Diagnosis Analysis [88]. Additional information on recording and analysis of laboratory results and other surveillance data is provided in Section 5.5.

#### Summary of investigations into the 2007 HPAI H5N1 outbreaks in Suffolk county

The investigation into the February 2007 outbreak of HPAI H5N1 in turkeys in Holton, Suffolk county involved visits to the affected and adjacent premises, interviews with staff on the premises, records reviews, ornithological analysis of wild bird activity in the area, molecular analysis of the HPAI virus recovered from the outbreak, identification and investigation of poultry farms potentially exposed to infection through contact or proximity, and increased wild bird surveillance in the area [5]. The affected premises were adjacent to a turkey slaughterhouse and two poultry processing plants. Molecular analysis of the virus revealed strong similarity to virus isolated from geese in Hungary in January 2007. Further investigation included analysis of import records for poultry products from Hungary, and exchanges of information with animal health authorities in Hungary. Based on the results of the investigation, Defra concluded that the most plausible explanation for the outbreak was that the turkeys in Holton were exposed to HPAI H5N1 virus from imported meat derived from pre-clinically infected turkeys. A potential means of exposure that was identified in the investigation was access by wild birds or rodents both to animal byproduct waste from the processing plants and to the single affected turkey house on the turkey farm.

Similar methods were used to investigate the November 2007 outbreak of HPAI H5N1 in Suffolk county [7]. The affected premises were part of a business producing turkeys, ducks and geese, including both free-range birds and birds reared in environmentally controlled buildings. During the investigation, only free-range turkeys and ducks were found to be infected, with a much higher prevalence of infection in the turkeys than in the ducks. Investigation of contact premises revealed infection in turkeys on a second premises. Stockmen using poor biosecurity practices tended birds at both premises. Results of the investigation, including genetic analysis of virus isolated from birds on both premises, indicated that the birds on the two premises were infected from a single source, and that the infection was likely transmitted from the index premises to the second premises. The virus was found to be phylogenetically distinct from the virus

isolated from the February 2007 outbreak in Suffolk county, and to be genetically similar to virus isolated from wild birds in continental Europe in mid-2007. The index premises were located near a lake that supports an estimated 1000 waterfowl. No epidemiological links with domestic poultry elsewhere in Europe were identified. The results of the investigation suggested that the HPAI H5N1 virus from this outbreak was introduced into Suffolk by migratory wild birds from elsewhere in Europe. Despite increased surveillance, no evidence was found of HPAI H5N1 virus infection in the wild bird population in Suffolk, or elsewhere in the UK.

### Conclusions

The requirements and procedures for investigating suspected and confirmed cases of avian influenza in the UK are well defined and documented. Defra procedures are consistent with EC requirements, and include procedures for epidemiological investigation, sample collection and testing, and recording and reporting of results. The HPAI H5N1 outbreaks in Suffolk county in 2007 were investigated promptly and thoroughly by UK animal health authorities, and results of the epidemiological investigations were published promptly.

### **5.5 Data management and analysis**

*The system for recording, managing and analyzing diagnostic and surveillance data was sufficient to demonstrate the effectiveness of the UK's HPAI H5N1 control measures.*

Information regarding animal health control activities in the UK is recorded in information technology systems administered by Animal Health [37]. The information is used to develop reports that are tailored to national and local requirements, including quarterly operational reports. Shortfalls in service are identified, recorded and reported to senior operations managers. Remedial action plans are developed to ensure that shortfalls are rectified. An Annual Report of the Chief Veterinary Officer describes progress towards strategic objectives, including disease control, surveillance and emergency preparedness, and serves as a continuous statistical record of the state of animal disease in Great Britain [97].

All diagnoses made by the VLA are recorded in the Veterinary Investigation and Diagnosis Analysis database [98]. Annual summaries of data from this database are published on the VLA website [98, 99]. Monthly summaries of interesting cases are published in the Veterinary Record [98]. The VLA compiles and analyzes surveillance data from regional laboratories to identify any occurrences of novel diseases or changes in disease occurrence trends, in both domestic animals and wildlife [100]. Monthly and quarterly surveillance reports are published on the VLA website. The monthly reports are also published in the Veterinary Record.

Data pertaining to poultry and poultry premises in Great Britain are maintained in the Great Britain Poultry Register, which was established in 2005 [101]. By law, all premises with 50 or more birds must be registered [101, 102]. Defra encourages registration of premises with fewer birds. Information collected includes names, addresses and contact information of the poultry keeper, poultry owner and premises; the numbers and types of poultry kept at the premises; and management practices [103]. As of February 2008, 24,269 premises and 251,913,661 birds had been registered. Data in

the Register are compiled and analyzed as part of the UK Veterinary Surveillance Strategy [104, 105]. The data are used to produce geographic maps showing density distributions of poultry premises, various poultry types and all poultry. These maps are published on the Defra website [103].

Defra conducts epidemiological investigations of animal disease occurrences in the UK, and publishes the results in detailed epidemiological reports. These are available on the Defra website, and include reports of the HPAI detections in 2007 and 2008 [106]. As noted in Section 5.3, Defra also monitors and analyzes animal disease occurrences in other countries. Results of the analyses are disseminated as preliminary outbreak assessments, qualitative risk assessments and routine summary reports that are distributed within the government, posted publicly on the Defra website, or published in the Veterinary Record [94].

Defra is currently developing and implementing an integrated information management system for various types of veterinary surveillance and related data from various sources [107]. This system, termed Rapid Analysis and Detection of Animal-Related Risks, is scheduled to be phased in from 2005 to 2013. Among the types of information to be included are data on agricultural holdings, land and livestock from UK government databases; animal health data from private veterinary practitioners and animal owners; information on carcass condemnations and other abattoir data; diagnostic data from veterinary laboratories; numbers of fallen stock consigned for destruction; and meteorological data. The system is designed to be part of an early warning system by facilitating identification of disease occurrences, and characterization of disease distributions and spread. Surveillance and other reports based on data from the system are available on the Defra website.

Another system through which information pertaining to animal disease occurrences in the UK is managed is the Animal Disease Notification System (ADNS). Through this system, information regarding outbreaks of infectious animal diseases, including avian influenza, is reported to the European Commission, and shared among ADNS members (EU Member States, Andorra, the Faroe Islands, Norway and Switzerland) [65, 108]. This electronic system is used to document and manage outbreak information, and is designed to facilitate rapid exchange of information among national authorities, outbreak monitoring, and coordination of response measures [108]. ADNS members are responsible for entering the appropriate data into the system, as specified by EC legislation [65, 108, 109]. Information on primary outbreaks is automatically sent to all Member States and the European Commission once it has been entered into the system [108]. The Commission compiles and sends information regarding primary and secondary outbreaks to Member States weekly. Summaries of the information, including maps showing outbreak locations, are publicly available on the website of the European Commission Directorate-General for Health and Consumer Protection [110].

As an EU Member State, the UK also participates in the Trade Control and Expert System (TRACES), an electronic system developed and maintained by the European Commission for transmission, storage and management of veterinary information relating to trade in animals and products of animal origin, for both trade that occurs within the Community, and trade that originates in countries outside the customs territory of the EC

[111-114]. Information in this system includes current statutory reference data, and data derived from common veterinary entry documents and animal health certificates.

### Conclusions

The system in place in the UK for recording, managing, and analyzing diagnostic and surveillance data is well developed and organized. Procedures are in place for collecting, compiling and analyzing the data, and are effectively implemented to further veterinary health goals and objectives in the UK, including control and eradication of HPAI H5N1.

## **5.6 Diagnostic laboratory capacity**

*Diagnostic laboratory capabilities were effective, and testing procedures were documented and standardized.*

Diagnostic testing for avian influenza in the UK is performed by the VLA. As noted in Section 5.1, the VLA is a network of 15 regional laboratories in England, Scotland and Wales, and a central research and diagnostic facility in Surrey County, England [57, 58]. The VLA is the national and EC reference laboratory for avian influenza, the United Nations Food and Agriculture Organization reference center for avian influenza and other poultry diseases, and the OIE reference laboratory for avian influenza [23, 37, 115]. VLA facilities are accredited by the UK Accreditation Service [37]. The VLA achieved International Organization for Standardization 9001:2000 certification in June 2005, and meets Code of Practice for Research standards as assessed by the UK Accreditation Service [116]. Various VLA units meet additional quality standards, including Good Laboratory Practice statutory requirements administered by the Department of Health.

Through its International Trade Program, the VLA provides laboratory testing and consulting services on animal health issues for international trade [117]. The VLA also performs animal disease risk assessments and provides surveillance and monitoring services to determine the disease status of animal populations in the UK for export certification. It produces a series of disease surveillance reports, including monthly Disease Surveillance Reports, an annual Wildlife Disease Report, and an annual Veterinary Investigation Surveillance Report [30].

At the national level, the VLA conducts avian influenza surveillance and diagnosis on samples collected within the UK [118]. In its role as the EC reference laboratory, the VLA develops and oversees programs for avian influenza surveillance in Europe, assists in diagnosis of avian influenza in other EU Member States, helps train laboratory personnel throughout the EU, collects and compiles avian influenza virus characterization data, supplies standardized reagents to other laboratories, and publishes protocols for avian influenza virus detection [23, 118]. The functions and duties of national reference laboratories of EU Member States, and of the EC reference laboratory, are specified by EC legislation [23]. The VLA also maintains a research program on influenza in birds and mammals [118].

EU Member States are required by EC legislation to ensure that diagnostic procedures, sampling and laboratory testing to detect the presence of avian influenza in poultry or other captive birds or avian influenza virus in mammals are carried out in accordance with the EC diagnostic manual for avian influenza [23, 95]. This manual specifies minimum biosecurity requirements and quality standards, laboratory tests to be used for

avian influenza diagnosis, and laboratory techniques for typing of avian influenza virus isolates. VLA protocols for detection and typing of avian influenza virus are consistent with EC and OIE standards and guidelines, and are published on the VLA website [119].

In the HPAI H5N1 outbreaks that occurred in Suffolk county in 2007, samples were collected from birds at the affected premises and submitted to the VLA within one day after the suspected occurrence was reported to animal health authorities, and diagnostic laboratory results were available the next day [5, 7, 25, 69]. Methods used by the VLA for HPAI H5N1 virus detection and characterization in these outbreaks include real-time polymerase chain reaction, virus isolation, nucleotide sequencing, intravenous pathogenicity index testing, hemagglutination inhibition testing and a neuraminidase inhibition assay [6, 120].

### Conclusions

The diagnostic laboratory infrastructure of the UK includes an internationally recognized authority on avian influenza diagnostics. The system in place in the UK for laboratory testing for avian influenza appears to be well organized, regulated and supervised. Sampling, testing and follow-up are performed in accordance with established protocols and international standards. Oversight is provided by the EC, and through accreditation to international standards. The system is effectively implemented, and provides quick turn-around for confirming or ruling out avian influenza occurrence.

## **5.7 Emergency control and eradication**

*Emergency control, biosecurity procedures and eradication program: The eradication program included the definition of appropriate quarantine and surveillance zones, monitoring of those zones, and implementation of movement restrictions. Measures taken by officials were effective in containing and controlling the spread of disease from these zones due to the effectiveness of program measures. Procedures for lifting quarantines were followed and were sufficient to prevent further spread of disease.*

Measures to be implemented for control and eradication of avian influenza in captive and wild birds in EU Member States are specified by EC legislation [121]. These measures include contingency planning, surveillance and reporting requirements, diagnostic procedures, and movement restrictions. These measures are summarized below, with a focus on control and eradication of avian influenza in captive birds. Additional information is available in the applicable EC legislation, on the Defra website, and elsewhere [121].

### Contingency planning

The European Commission requires that all EU Member States develop a contingency plan that specifies the national measures to be implemented in the event of an outbreak of avian influenza, and to submit that plan to the European Commission for approval [23]. The contingency plan must be developed in accordance with detailed criteria that are specified by the European Commission. The plan must provide for access to facilities, equipment, personnel and all other appropriate materials necessary for rapid and efficient eradication of an outbreak. It must indicate the number and location of all commercial poultry holdings, and the maximum number of poultry, by species, that could be present on these holdings. Member States must also estimate the amount of vaccine that would

be needed in the event of emergency vaccination. The plan must be updated at least every five years and submitted to the European Commission for approval. The UK contingency plan for avian influenza has been approved by the European Commission [122].

The contingency plan for responding to suspected and confirmed cases of exotic animal diseases in England is contained in Defra's Contingency Plan for Exotic Animal Diseases. This plan consists of two parts: an Overview of Emergency Preparedness, which contains details of operational response preparedness; and a Framework Response Plan for Exotic Animal Diseases, which contains policy information for responses to specific diseases, including avian influenza [123]. It is reviewed and amended annually based on scientific findings, policy developments, and lessons learned in any outbreaks that occurred. Separate contingency plans for Wales, Scotland and Northern Ireland are developed by the respective government bodies for these regions [124]. These separate plans, while specific to the institutional structures of the respective regions, are designed to be mutually complementary. The Framework Response Plan calls for close cooperation and coordination among the respective government bodies in the event of a suspected or confirmed case of exotic animal disease.

#### Suspected or confirmed avian influenza

Measures to be taken in the event of suspected avian influenza occurrence on captive bird holdings in EU Member States are specified by EC legislation [23]. The competent authority must immediately initiate an investigation to confirm or rule out avian influenza occurrence, in accordance with the EC diagnostic manual for avian influenza, and place the holding under official surveillance. The competent authority must also ensure that all animals on the holding are accounted for; that contact of all captive birds on the holding with captive birds on other holdings and with wild birds is prevented or minimized; that appropriate movement restrictions and biosecurity measures are imposed to prevent spread of avian influenza; and that an epidemiological investigation is carried out. Additional measures to be carried out in the event of confirmed HPAI occurrence include killing of all captive birds on the holding, disposal of all carcasses and eggs on the holding, and cleaning and disinfection of the holding (see Section 5.8). Similar requirements apply to cases of suspected or confirmed HPAI occurrence in slaughterhouses, at border inspection posts and in means of transport.

The competent authority is authorized to grant derogations to these requirements, under conditions specified by EC legislation [23]. Examples of cases in which such derogations might be granted are for conservation of endangered species or officially registered rare breeds. The derogations must not endanger disease control efforts, and must be reported immediately to the European Commission.

#### Protection zone, surveillance zone and further restricted zone

In the event of HPAI occurrence, the competent authority must immediately establish a protection zone of at least 3 km radius and a surveillance zone of at least 10 km radius around the affected holding [23]. Criteria to be considered in defining these zones include results of the epidemiological investigation, natural boundaries, the locations and proximity of holdings, the estimated numbers of poultry, patterns of captive bird movement and trade, and the resources available for movement control. The competent

authority may establish further restricted zones around or adjacent to the protection and surveillance zones, taking into account these criteria.

In the event of HPAI H5N1 occurrence, the Member State must designate an area A and area B, for the purposes of avian influenza control and eradication [125]. Area A, consisting of both the protection zone and the surveillance zone, is classified as a high risk area. Area B, which can include all or part of any further restricted zone, is classified as a low risk area, and is designed to separate area A from any disease-free region of the Member State, or from neighboring countries.

Measures to be taken in these zones are specified by EC legislation [23]. In both the protection zone and the surveillance zone, measures must be implemented that permit tracing of anything likely to spread avian influenza virus, including birds, meat, eggs, carcasses, feed, litter and people. In addition, the competent authority must take all reasonable steps necessary to ensure that all people in the protection and surveillance zones are fully aware of the restrictions in place. Other measures required for both protection and surveillance zones include conducting a census of holdings in the zones; implementation of strict movement controls; cleaning and disinfection or appropriate disposal of vehicles, equipment, feed, manure, bedding or other materials likely to be contaminated; and restrictions on removal or spreading of used litter or manure. Any significant changes in morbidity, mortality and production levels on holdings must be reported immediately to the competent authority. The competent authority must ensure that fairs, markets, shows and other gatherings of captive birds are prohibited in the protection and surveillance zones.

Additional measures to be applied in the protection zone include additional surveillance to detect any spread of avian influenza; measures to prevent or minimize contact of birds on holdings in the protection zone with birds on other holdings or wild birds; and visits to commercial holdings by an official veterinarian for clinical examination of birds and sample collection [23]. Records must be kept of official veterinarian visits and findings, and of all other persons visiting holdings in the protection zone.

EC legislation allows the competent authority to require that some or all of these measures be implemented in any further restricted zone that is established, and allows for preventive slaughter of captive birds in areas of risk, in accordance with specified criteria [23]. These criteria include the level of susceptibility of the poultry species to avian influenza, the location of contact holdings and the density of poultry in the area, the duration of disease presence in the area, the likelihood of spread, the extent of epidemiological linkage to affected holdings, and whether the outbreak is under control. Implementation of such measures in the further restricted zone must be reported immediately to the European Commission.

Additional movement restrictions apply to areas A and B established in response to HPAI H5N1 occurrence [125]. The Member State must ensure that no captive birds or hatching eggs are moved from area B. Also, the Member State must ensure that no products for human consumption derived from wild feathered game are moved from areas A and B; and that no captive bird gatherings, such as at fairs, markets and shows, are held in area B. Exceptions and derogations are available for some categories of birds and commodities, such as pets and birds for display or research, day-old chicks and hatching

eggs; and some categories of movement, such as movement of poultry to slaughter or to another holding. These exceptions and derogations are clearly defined and include provisions to mitigate the risk of avian influenza spread.

The measures applicable to the protection zone must remain in place for at least 21 days after preliminary cleaning and disinfection (see Section 5.8) of the affected holding are completed, and until holdings in the protection zone have been tested in accordance with procedures specified in the diagnostic manual for avian influenza [23]. Thereafter, the measures applicable to the surveillance zone must be applied in the former protection zone as well as in the surveillance zone, until those are lifted. The surveillance zone measures must remain in place for at least 30 days after preliminary cleaning and disinfection of the affected holding are completed.

### Vaccination

Vaccination against avian influenza in EU Member States is permitted as a short-term, emergency measure to contain an outbreak, and as a longer-term, preventive measure [23]. In both cases, the Member State must submit a vaccination plan to the European Commission for approval. Information to be included in the plan includes the reasons for vaccination, the geographic area in which vaccination is to be carried out, the species, categories and number of birds to be vaccinated, the estimated duration of the vaccination program, provisions for movement of vaccinated birds, recordkeeping requirements, and vaccine characteristics. The plan must allow for differentiation of infected from vaccinated animals, and must include information on clinical and laboratory tests to be carried out to monitor the epidemiological situation, the effectiveness of the vaccination campaign, and the control of movement of vaccinated birds.

Member States must ensure that avian influenza viruses, genomes, antigens and vaccines for research, diagnosis or vaccine manufacture are used only at sites approved by the competent authority where appropriate biosecurity requirements are guaranteed [23].

### Indemnity and compensation

The EC provides financial contributions toward the cost of specific veterinary measures, inspection measures, and programs for the eradication and monitoring of animal diseases, including avian influenza. Eligible costs, and the conditions under which such contributions are provided, are specified by EC legislation [126]. Eligible costs include costs of slaughter, cleaning and disinfection, establishment of protection zones, and vaccines and vaccination.

### Control measures applied in the 2007 HPAI H5N1 outbreaks in Suffolk county

In response to the outbreaks of HPAI H5N1 in Suffolk county in 2007, emergency control and eradication measures were implemented in accordance with EC requirements. Defra placed the affected premises under restriction and implemented an emergency response plan immediately upon the report of suspected avian influenza occurrence [25, 69]. Additional control measures were implemented upon laboratory confirmation of HPAI H5N1 virus infection. The protection, surveillance and further restricted zones were defined and established in accordance with EC requirements. Vaccination of poultry was prohibited [8, 24]. The zone boundary definitions, including maps, as well as the restrictions applying to the zones, were published on the Defra website. In each

outbreak, the control zones remained in place until at least 30 days after preliminary cleaning and disinfection of the premises had been completed [22, 28].

### Conclusions

A well-developed system is in place in the UK to respond to suspected or confirmed HPAI occurrence. Both UK and EC legislation appears to provide sufficient authority for a rapid and thorough response by animal health authorities. Emergency response measures are developed in accordance with EC regulations. Procedures are well documented, and were promptly implemented during the 2007 HPAI H5N1 outbreaks in Suffolk county. The control and eradication measures that were implemented were effective in preventing spread of the disease and quickly eradicating it.

### **5.8 Premises depopulation, cleaning and disinfection procedures**

*Documented standard operating procedures included procedures for depopulation, cleaning, disinfection, and other applicable measures, such as carcass disposal. All relevant personnel were familiar with these standard procedures and followed them during the outbreak. These measures were effective in controlling the disease.*

Procedures to be followed for depopulation, carcass disposal, cleaning, disinfection and repopulation of premises in the event of avian influenza occurrence in the UK are specified by EC and UK legislation [23, 50]. These procedures must be carried out under official supervision, and in accordance with instructions from the official veterinarian [23]. Depopulation must be carried out in such a way as to avoid the risk of spreading avian influenza, in particular during transport. The cleaning and disinfection carried out must be documented.

On holdings on which HPAI occurrence is confirmed, all captive birds must be killed without delay [23]. As part of preliminary cleaning and disinfection, the carcasses must be sprayed with disinfectant prior to disposal. Immediately after disposal, the buildings in which the birds were housed, and equipment and vehicles likely to be contaminated, must be cleaned and disinfected. The disinfectant must remain in place for at least 24 hours. In final cleaning and disinfection, manure and used bedding must be removed and destroyed or treated, and surfaces must be degreased, cleaned and disinfected. After 7 days, the holding must be degreased, cleaned and disinfected again. The disinfectants to be used, and the concentrations at which they are to be used, must be authorized by the competent authority. Defra maintains a list of approved disinfectants and dilution rates on its website [127]. Equipment or materials that are likely to be contaminated but that cannot be effectively cleaned and disinfected must be destroyed.

Procedures for repopulating commercial holdings are specified by EC legislation [23]. Repopulation within 21 days after final cleaning and disinfection is prohibited. During the 21 days after repopulation, the poultry must undergo at least one clinical examination by an official veterinarian; any poultry that die must be tested in accordance with the EC diagnostic manual for avian influenza; no poultry is permitted to leave the holding without authorization from the competent authority; and the owner must monitor production data, including morbidity and mortality data, and immediately report any significant changes to the competent authority. Any land or pastures used by captive birds on a holding where avian influenza was confirmed to occur must not be used by

captive birds until the competent authority determines that any avian influenza virus present has been eliminated or inactivated [23].

The emergency response measures implemented during the HPAI H5N1 outbreaks in Suffolk county in 2007 included premises depopulation, cleaning and disinfection in accordance with EC requirements. In the case of the February 2007 outbreak in Suffolk, the suspected occurrence of avian influenza was reported on the evening of February 1, 2007 [5]. The next day, culling of the remaining birds on the premises began. Culling of the approximately 159,000 birds on the premises was completed on February 5 [4, 5]. Preliminary cleaning and disinfection were completed by February 8 [5]. In the case of the November 2007 outbreak in Suffolk, the suspected occurrence of avian influenza was reported on November 11 [7]. Culling of the remaining 6300 birds on the index premises began on November 13 [6, 7]. The remaining 9000 birds on the second affected premises were culled on November 15 and 16 [7, 8]. Preliminary cleaning and disinfection were completed on November 19 [7].

### Conclusions

Requirements and procedures for premises depopulation, cleaning and disinfection are well defined and documented. Both UK and EC legislation appear to provide sufficient authority for a rapid and thorough response by animal health authorities. During the 2007 HPAI H5N1 outbreaks in Suffolk county, the procedures were promptly implemented and completed, in accordance with EC requirements. The measures taken were effective in preventing spread of the disease and quickly eradicating it.

## 6. Risk Estimation and Conclusions

The epidemiological investigations into the 2007 HPAI H5N1 outbreaks in Suffolk county revealed two likely pathways for introduction of HPAI H5N1 onto the affected premises - the importation of meat from infected birds, and migration of infected wild birds. Risk factors for transmission of HPAI H5N1 to or within the domestic poultry population that were identified include flock management and poor biosecurity practices such as ones that allowed exposure of domestic poultry to wild birds or contaminated materials.

Specific factors that were identified as potentially contributing to the February 2007 HPAI H5N1 outbreak in Suffolk county are poor biosecurity associated with animal by-product disposal at the turkey processing plant, and poor maintenance conditions of one of the turkey houses, which might have allowed access by small wild birds or rodents, or water potentially contaminated by birds outside. A main risk factor identified in the November 2007 HPAI H5N1 outbreak in Suffolk county was the location of free-range poultry premises in close proximity to open water, which might attract wild birds and increase the likelihood of contact and transmission of avian influenza virus to the free-range turkeys on the premises [7].

Eliminating all risk of introduction and spread of HPAI H5N1 virus is difficult or impossible. The risks in the UK are substantially mitigated by several prevention, detection, control and eradication measures. Strict import regulations supported by both UK and EC legislation mitigate the risk of importing avian influenza virus in animals and animal products. Additional measures are in place to mitigate the risk of spread should the virus be introduced. Rapid detection and reporting allow for rapid response to limit spread. Rapid detection and reporting are encouraged in the UK by extensive outreach efforts by Defra to raise and maintain awareness among veterinary professionals and the public, and in particular bird keepers, of clinical signs of avian influenza, and of reporting requirements and the importance of prompt reporting. A program in place for targeted surveillance for avian influenza in wild birds is designed to increase the likelihood of early detection in wild birds.

The risk of HPAI H5N1 spread is also mitigated by prompt implementation of strict movement controls. Precautionary controls are implemented upon suspected occurrence of avian influenza. These are expanded in the event of laboratory confirmation. The criteria and procedures for establishing the respective control zones are well defined and documented, as are the applicable restrictions. Risk of spread is further mitigated by thorough investigation and follow-up by animal health authorities. Potential sources and routes of infection are identified, and additional control and eradication measures are implemented as necessary. Procedures for eradication, including depopulation, cleaning and disinfection of affected premises, are well defined and documented.

In conclusion, although the risk of HPAI H5N1 introduction into the UK cannot be eliminated, a well-developed system is in place to rapidly detect, control and eradicate it should it occur. The effectiveness of this system was demonstrated during each of the HPAI H5N1 outbreaks in Suffolk county in 2007. The results of this evaluation suggest that the risk of HPAI H5N1 spread within the domestic poultry population in the UK is low; and indicate that HPAI H5N1 was eradicated from Suffolk county and has not

recurred there since the November 2007 outbreak. APHIS found no evidence that HPAI H5N1 is currently present in Suffolk or Norfolk county. Thus, APHIS concludes it to be appropriate to remove Suffolk and Norfolk counties from the list of regions that APHIS considers to be affected with HPAI H5N1.

## 7. Appendix

### 7.1 List of EC legislation pertaining to avian influenza control.

Below is a list of the main instruments of EC legislation pertaining to avian influenza control in EU Member States. The list was compiled based on information from an avian influenza-specific section of the website of the Office for Official Publications of the European Communities [128]. Copies of the original legislation and any amendments are available through the same website [46, 128].

1. 2007/598/EC: Commission Decision of 28 August 2007 concerning measures to prevent the spread of highly pathogenic avian influenza to other captive birds kept in zoos and approved bodies, institutes or centres in the Member States. Official Journal L 230, 01/09/2007 P. 0020 - 0026.
2. 2007/268/EC: Commission Decision of 13 April 2007 on the implementation of surveillance programmes for avian influenza in poultry and wild birds to be carried out in the Member States and amending Decision 2004/450/EC (notified under document number C(2007) 1554). Official Journal L 115, 03/05/2007 P. 0003 - 0017.
3. 2007/25/EC: Commission Decision of 22 December 2006 as regards certain protection measures in relation to highly pathogenic avian influenza and movements of pet birds accompanying their owners into the Community. Official Journal L 008, 13/01/2007 P. 0011 - 0011; Official Journal L 008, 13/01/2007 P. 0029 - 0034; Official Journal L 219, 24/08/2007 P. 0053 - 0058.
4. 2007/24/EC: Commission Decision of 22 December 2006 approving contingency plans for the control of avian influenza and Newcastle disease. Official Journal L 008, 13/01/2007 P. 0010 - 0010; Official Journal L 008, 13/01/2007 P. 0026 - 0028; Official Journal L 219, 24/08/2007 P. 0050 - 0052.
5. 2006/563/EC: Commission Decision of 11 August 2006 concerning certain protection measures in relation to highly pathogenic avian influenza of subtype H5N1 in wild birds in the Community and repealing Decision 2006/115/EC. Official Journal L 222, 15/08/2006 P. 0011 - 0019; Official Journal L 118, 08/05/2007 P. 1087 - 1095.
6. 2006/415/EC: Commission Decision of 14 June 2006 concerning certain protection measures in relation to highly pathogenic avian influenza of the subtype H5N1 in poultry in the Community and repealing Decision 2006/135/EC. Official Journal L 164, 16/06/2006 P. 0051 - 0060; Official Journal L 118, 08/05/2007 P. 0894 - 0903.
7. 2005/94/EC: Council Directive 2005/94/EC of 20 December 2005 on Community measures for the control of avian influenza and repealing Directive 92/40/EEC. Official Journal L 010, 14/01/2006 P. 0016 - 0065; Official Journal L 270, 29/09/2006 P. 0005 - 0054.
8. 2005/734/EC: Commission Decision of 19 October 2005 laying down biosecurity measures to reduce the risk of transmission of highly pathogenic avian influenza

- caused by Influenza virus A subtype H5N1 from birds living in the wild to poultry and other captive birds and providing for an early detection system in areas at particular risk. Official Journal L 274, 20/10/2005 P. 0105 - 0107; Official Journal L 349, 12/12/2006 P. 0472 - 0474.
9. 2005/731/EC: Commission Decision of 17 October 2005 laying down additional requirements for the surveillance of avian influenza in wild birds. Official Journal L 274, 20/10/2005 P. 0093 - 0094; Official Journal L 349, 12/12/2006 P. 0460 - 0461.
  10. 2005/692/EC: Commission Decision of 6 October 2005 concerning certain protection measures in relation to avian influenza in several third countries. Official Journal L 263, 08/10/2005 P. 0020 - 0021; Official Journal L 349, 12/12/2006 P. 0424 - 0425.
  11. 2005/464/EC: Commission Decision of 21 June 2005 on the implementation of survey programmes for avian influenza in poultry and wild birds to be carried out in the Member States. Official Journal L 164, 24/06/2005 P. 0052 - 0056; Official Journal L 349, 12/12/2006 P. 0150 - 0154.
  12. 97/78/EC: Council Directive 97/78/EC of 18 December 1997 laying down the principles governing the organisation of veterinary checks on products entering the Community from third countries. Official Journal L 024, 30/01/1998 P. 0009 - 0030.
  13. 82/894/EEC: Council Directive 82/894/EEC of 21 December 1982 on the notification of animal diseases within the Community. Official Journal L 378, 31/12/1982 P. 0058 - 0062.
  14. 798/2008: Commission Regulation (EC) No 798/2008 of 8 August 2008 laying down a list of third countries, territories, zones or compartments from which poultry and poultry products may be imported into and transit through the Community and the veterinary certification requirements. Official Journal L 226, 23/08/2008 P. 0001–0094.
  15. 2006/437/EC: Commission Decision of 4 August 2006 approving a Diagnostic Manual for avian influenza as provided for in Council Directive 2005/94/EC. Official Journal L 237, 31/08/2006 P. 0001–0027; Official Journal L 118M, 08/05/2007 P. 1285–1311.

## **7.2 List of UK legislation pertaining to avian influenza control in England.**

Below is a list of the main instruments of UK legislation pertaining to avian influenza control in England. The list was compiled based on information from the Defra website [44, 55, 129]. Copies of the original legislation and any amendments are available through the Defra website, or from the website of the UK Office of Public Sector Information [44, 45, 129]. Tables of EC animal health legislation and corresponding UK implementing legislation are also available on the Defra website [44].

1. The Animal Health Act 1981.

2. The Animal Health Act 1981 (Amendment) Regulations 2005; Statutory Instrument No. 3475.
3. The Avian Influenza and Newcastle Disease (England and Wales) Order 2003; Statutory Instrument 2003 No. 1734.
4. The Avian Influenza and Newcastle Disease (Contingency Planning) (England) Order 2003; Statutory Instrument 2003 No. 2036.
5. The Avian Influenza and Newcastle Disease (Biosecurity and Disease Control (Slaughter) Protocol) (England and Wales) Order 2003; Statutory Instrument 2003 No. 2035.
6. The Avian Influenza and Influenza of Avian Origin in Mammals (England) (No. 2) Order 2006; Statutory Instrument 2006 No. 2702.
7. The Avian Influenza (Preventive Measures) (England) Regulations 2006; Statutory Instrument 2006 No. 2701.
8. The Avian Influenza (H5N1 in Poultry) (England) Order 2006; Statutory Instrument 2006 No. 3247.
9. The Avian Influenza (H5N1 in Wild Birds) (England) Order 2006; Statutory Instrument 2006 No. 3249.
10. The Avian Influenza (Vaccination) (England) Regulations 2006; Statutory Instrument 2006 No. 2703.
11. The Official Controls (Animals, Feed and Food) (England) Regulations 2006; Statutory Instrument 2006 No. 3472.
12. The Animals and Animal Products (Import and Export) (England) Regulations 2006; Statutory Instrument 2006 No. 1471.
13. The Products of Animal Origin (Third Country Imports) (England) Regulations 2006; Statutory Instrument 2006 No. 2841.

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